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# USSR Report

TRANSPORTATION

No. 103

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AIR

## TU-154M TEST FLIGHT EXAMINED

Moscow PRAVDA in Russian 14 Oct 82 p 6

[Article by A. Gorokhov, PRAVDA special correspondent: "Extreme Conditions: Reporting from on board the TU-154M"]

[Text] /They put our airplane in a place somewhere on the outskirts of the airport. And so its enormous tail was outlined against the light-blue southern sky like an enormous white applique, practically no different than other similar, three-engined TU's. However, the chief of the Adler Airport, I. Polishchuk kept for a long time the crew of test people from the Design Bureau imeni A. N. Tupolev which had come down the accommodation ladder: for, you know, on the sloping side of the airliner were the quite unfamiliar letters TU-154M/ [in boldface]

A curiously interesting photograph has been preserved, which is sixty years old--in a direct sense, the same age of the design group: Tupolev, who was then a department chief of the TsAGI [Central Aero-Hydrodynamic Institute imeni N. Ye. Zhukovskiy], together with his few staff members, are making a strength test of a longeron [wing spar]--the main strength beam for the wing of his first airplane, the ANT-1. The method of testing, it must be said, was a simple one. They attached the beam to the wall of a tavern (the latter was situated right next to a merchant's private home on Moscow's Voznesenskaya Street, now named Radio Street, where they had also built the airplane), and, well...they just crawled out onto the longeron.

"Now, Sasha, sit down on the edge; it will be somewhat easier for us not to have you get all smashed up, in case the thing breaks," that is something like what Tupolev told Aleksandr Ivanovich Putilov, who subsequently became a well-known aircraft designer.

They placed themselves at intervals, like birds on wires, and were photographed: on the extreme right, near the wall, was Yevgeniy Ivanovich Pogoskiy, pilot and engineer. It was he who later took the ANT-1 up into the air, thereby becoming the first in a brilliant list of test-pilots for the ANT's and TU's. This list is a long one, inasmuch as over a period of 60 years the number of experimental and serial-production airplanes developed by the Tupolev Design Bureau has exceeded 160.

...The airliner's passenger cabin, plentifully stocked with registering equipment, was quite deserted: there were only a few persons, ourselves included, who were designated in the language of aviation documents as "service passengers." This, then, was one of those rare cases when it was possible to observe the actions of flight personnel up close. The chief engineer, S. Avakimov is an acquaintance of mine of long standing: we first met, I remember, about 10 years ago on board an experimental airplane. Then Sergey keenly suffered from being dropped out of test-pilot school: "Barred for medical reasons."

"A number of new systems have been installed on this airplane, but the most important one consists of the D-30KU turbo-fan engines, which are new for this class of passenger airplanes. They are extremely economical, so that, I think, it will be possible to carry on the modified TU-154 up to 150 passengers from Moscow to Khabarovsk without landings along the way," Avakimov explained to us.

And when we proceeded from "iron" to people, the test personnel, Avakimov, supported by the other chief engineer, B. Ivlev, stated the following:

"Regarding the ship's commander, Sergey Timofeyevich Agapov, there is little to be said--he is a master. Find another word which would be more beautiful...."

A dictionary of Russian synonyms has, perhaps, given us the most correct one: "master--golden hands," and, speaking for ourselves, we would add "golden head" as well. And that his hands and head have been marked by gold is testified to directly by the following fact: USSR Honored Test-Pilot S. T. Agapov has just become a Hero of the Soviet Union.

Half a century ago, when the little boy Serezha Agapov was born, there was loud and universal glory for one of the first test-pilots of the Tupolev airplanes--M. M. Gromov. In his youth Agapov heard the names V. P. Chkalov, A. B. Yumashev, M. A. Nyukhtikov, and then, at a more mature age--those of A. D. Perelet, Yu. T. Alashev, and A. D. Kalina. And later, when he had graduated from the flight school at Omsk, and when he had been trained at the test-pilot school, he himself already had joined this glorious line of formation. In December of his 23rd year Agapov became part of the "firm."

It is impossible to describe simply Andrey Nikolayevich Tupolev's attitude toward his test personnel. According to the testimony of one of his closest colleagues, L. L. Kerber, withal the great warmth and attention of a general designer for his pilots, he soberly evaluated the individual qualities and skills of each one. But, above all, what he valued in them was ability, talent, the "divine gift."

"Pilots are, nevertheless, people of this earth, just like you and me," said the academician.

...We talked with Agapov in the airliner's cabin. This completely "down-to-earth" man is called in the Design Bureau a specialist on extreme conditions. On an airplane which he was working on, together with Hero of the Soviet Union Mikhail Kozlov, he landed on one "leg," and he took off, after rejecting the use at the most unsuitable moment of the elevator control flaps [?], which are supposed to "quiet down" the airplane after it leaves the runway strip. On another airplane he barely

avoided being burned up.... On many airplanes he has "felt out" this most notorious extreme, this "edge," beyond which there is nothing left. And on one such occasion he passed the limit and was thrown into a spin in a heavy airplane which was not equipped, of course, to stand up under such air movements.

"But you've had enough of this spin," laughed Sergey Timofeyevich and began to talk about his own crew.

The co-pilot, Vladimir Matveyev, is a student of Agapov's, and he recently obtained his first-class test-pilot ranking. This year Aleksandr Nikolayev was awarded the title "USSR Honored Test-Navigator." The on-board radio-operator, Sergey Ivanov, is a USSR Honored Radio-Operator. Matching him in skill is also the on-board engineer, Valentin Ignatov.

Only one crew out of many, only one small cell of the great group of scientists, designers, and workers who entrust the fruits of their own work to the test personnel. This work at the very "edge" is marked by the highest measure of responsibility. Exactly 10 years ago Academician Tupolev wrote as follows in the pages of PRAVDA: "...that which is being created by us is the fruit of the labor of the entire aviation industry, the work of the plants and factories of many sectors of Soviet industry." There is no exaggeration in these words. The modern-day airplane is like a satellite or an orbital station: without the cooperation of many units it will not be made. At times, you know, it has happened that the designers' search for space and outer-space equipment has led not only to a radical break in the "established" sectors of science and production but also to the creation of completely new ones.

Academician Tupolev never liked the question about his favorite airplane. He never tired repeating that "favorite" implied a pet design. And that would mean running in place. But Tupolev would never allow that. In his Design Bureau one thing always remained uppermost--to solve the key problems of airplane construction.

...At an airport near Moscow we took our leave of the test-personnel brigade. A regular flight had been completed, and its log will occupy, perhaps, only a modest line in multi-volume reports. Tomorrow they will all go up into the sky again.

And they will operate under extreme conditions so that you and I can travel through the air without extreme situations.

/Shown in Photograph: The flight completed, in the foreground--USSR Honored Test-Pilot, Hero of the Soviet Union S. T. Agapov./ [in boldface]

2384

CSO: 1829/38

AIR

BRIEFS

HIJACKING REPORTED--On 7 November of this year, on board a Soviet AN-24 passenger plane completing a regular flight on the Krasnodar-Novorossiysk-Odessa route, three armed bandits attacked the crew and forced them to land in the Turkish city of Sinop. In the course of the hijacking one crew member and one passenger were wounded by the bandits. On the next day, 8 November, the airplane with the crew and passengers returned home. The Soviet Government has addressed the Turkish Government with a demand that the criminals who hijacked the plane be turned over immediately. [Text] [Moscow VOZDUSHNYY TRANSPORT in Russian 13 Nov 82 p 4]

CSO: 1829/55



## MOTOR VEHICLE

### MODEL FOR EVALUATING EFFICIENCY OF FREIGHT TRANSPORT INDICATORS

Moscow EKONOMIKA I MATHEMATICHESKIYE METODY in Russian No 5, Sep-Oct 82 pp 875-883

[Article by B. L. Geronimus and A. I. Novikova, Moscow: "Simulation Model for Evaluating the Efficiency of Systems of Planning Indicators in Truck Transportation"]

[Text] The literature describes dozens of examples of successful use of simulation models to determine rational production regimes, to select shipping routes, to develop economic facilities, and the like. Some works show the possibility of using the model to refine the management and planning of enterprises and sectors (see [1, 2] et al.). This approach can be used to evaluate the efficiency of various proposals for development of the system of planning indicators being ratified for particular economic facilities, which is very important in the stage of developing such measures. This is illustrated by experience with the preparation of proposals to refine the system of planning indicators ratified for truck transportation enterprises (GATP's). This work was begun in the mid-1960's [3]. In 1971 Glavmosavtotrans [Main Administration of Motor Vehicle Transportation of the Moscow City Executive Committee] instituted methodological instructions on further refinement of planning, economic stimulation, and management in which one of the principal planning indicators was volume of income, while freight turnover was excluded [4]. In 1976 similar methodological instructions were developed for the Ministry of Motor Vehicle Transportation of the Kazakh SSR, but in addition to income freight turnover was also included as an indicator to be ratified. The RSFSR Ministry of Motor Vehicle Transportation until 1981 used both shipping volume and freight turnover.

As special studies testify, even after different motor vehicle transportation organizations have been working under particular systems of ratified plan indicators for an extended time and some statistical material on the actual results of their work has been accumulated, it is still difficult to draw reliable conclusions about the advantages and shortcomings of a particular system. After all, work results reflect other factors along with institution of the new system of planning. For example, Glavmosavtotrans works in different conditions than enterprises of the Kazakh SSR Ministry of Motor Vehicle Transportation. This is related not only to specific characteristics of shipping work, but also to the level of enterprise development achieved. This is exactly why all attempts to find a basis for a quantitative evaluation of the efficiency of different systems

of planning indicators used in GATP's of Glavmosavtotrans, the Alma-Ata Administration of Truck Transportation of the Kazakh SSR Ministry of Motor Vehicle Transportation, and Glavlensavtotrans [Main Administration of Motor Vehicle Transportation of the Leningrad city Executive Committee] of the RSFSR Ministry of Motor Vehicle Transportation have ended in failure. Such an evaluation has been made only on the qualitative level, which did not provide adequate support for its conclusions. Therefore, in 1977-1979 when studies on further refinement of planning systems were being made at NIIAT [State Scientific Research Institute of Motor Vehicle Transportation of the RSFSR Ministry of Motor Vehicle Transportation], it was decided to use the techniques of simulation modeling for a quantitative evaluation of the efficiency of introducing new systems of ratified plan indicators.

Due consideration was given to the shortcomings of existing systems, above all the fact that they oriented GATP's to strive for maximum volume of freight turnover in ton-kilometers, not to meet the needs of specific freight shippers for shipping. They motivated them to raise quantitative indicators, not qualitative ones, which led to inadequate efficiency of the shipping process from a national economic point of view.

Based on a study of theoretical work (in particular [5-7]), the experience of a number of motor vehicle transportation enterprises (see [4, 8] and others), and industrial sectors (for example [9, 10]) with refining the economic mechanism, proposals were prepared on improving the system of ratified planning indicators for motor vehicle transportation enterprises to best correlate with the fundamental principles of the 12 July 1979 decree of the CPSU Central Committee and USSR Council of Ministers. Planning was considered here together with the process of plan realization, including ongoing management and simulation of production activity proper [11, p 8]. Only then is it possible to make a more or less reliable prediction of the productivity of particular alternative systems of ratified planning indicators.

The key principle for refining the system was orienting GATP's primarily to meeting the needs of the national economy for truck shipping according to economic contracts between GATP's and freight owners. Therefore, the volume of freight shipping in tons for mandatory (contract) clients was adopted as one of the main ratified planning indicators. The indicator of net (calculated) profit was proposed to reflect the efficiency of activity of the GATP's, while the indicator of the total volume was taken as total sum of income, which in motor vehicle transportation corresponds to commodity output. All the other ratified planning indicators adopted for motor vehicle transportation were the same as envisioned by the above-mentioned decree for all industrial sectors.

The efficiency of the system under consideration compared to the currently used system was evaluated by the method of computer simulation modeling of the process of decision-making at the GATP on performance of freight shipping based on orders from clients with available rolling stock, and an appropriate model was developed. It was assumed that the receipt of orders for freight shipping from clients was random for each order and for shipping volume. Beginning from the available trucks of different makes, the number of vehicles working on the line was randomly set at definite numbers. The model envisioned the possibility

of simulating work to ship freight in time, that is, from day to day beginning from the first. If there were deviations from curtailment of plan assignments or refusal to ship freight on the previous day, this was taken into account on the next day. The model was constructed so that it can be used to simulate decision-making both under conditions of the currently operating system of planning and economic stimulation or the proposed system. The expediency of decision-making was determined by a list of indicators which are used to evaluate the activity of a GATP and by the statute on bonus payments to its workers. It was assumed that the question of accepting the freight of a particular client for shipping would be decided in the interests of the GATP and its collective. And they strive to fulfill the assignments established by the plan so that, in conformity with established rules for evaluating the activity of the GATP, they will form the maximum economic stimulation funds and employees will receive the maximum bonus.

Thus, this simulation model should reflect a management orientation to the fullest combination of public interests and the interests of the GATP. The transfer of state enterprises to cost accounting "in connection with the pressing need to raise labor productivity, see that every state enterprise makes a profit, in connection with the inevitable departmental interest and exaggeration of departmental effort, necessarily gives rise to a certain conflict of interests" [V. I. Lenin, "Poln. Sobr. Soch." (Complete Works), Vol 44, p 343]. This contradiction can only be resolved on the basis of the greatest correlation between systems of ratified planning indicators and systems for evaluating the work and stimulating enterprise employees. In this situation general state interests are expressed through a set of such indicators, while the interests of employees are expressed through the moral and material incentive system. Because moral incentive is difficult to formalize, this model takes account only of material incentive through the formation of corresponding funds and amounts of bonus payments to employees (decision-makers) of the GATP.

Based on this, the following order of decision-making was proposed:

1. during simulation of the existing system of planning primary consideration is given to the indicators by which the activity of the ATP [motor vehicle transportation enterprise] is evaluated and their fulfillment is a mandatory condition for the formation of economic stimulation funds, that is, the plan for shipping for mandatory contract clients and for freight turnover. Secondly, the model takes into account indicators which determine the amount of the material incentive fund (including the indicators of profit and profitability), and thirdly it refers to fulfillment of the plan for labor productivity and income, which determines the amount of bonus payment to employees;
2. during simulation of the proposed system of planning consideration is given first to fulfillment of the shipping plan in tons for mandatory contract clients and the income plan, an essential condition for the formation of economic incentive funds. Then attainment of planned profit is considered because the amount of the funds depends on this. Finally,

fulfillment of the plan for labor productivity is reflected, because this factor determines the size of bonuses.

To compare the efficiency of the existing and proposed systems, the amount of total national economic costs related to movement of the freight from the shippers to receivers on the condition of maximum use of the carrying capacities of the trucks was employed as the evaluation criterion. It was considered here that the need for freight shipping is always greater than carrying capacity and therefore the managing body of motor vehicle transportation can select freight for shipping and refuse shipment for noncontract clients.

National economic costs of moving freight were determined on the basis of generally accepted principles concerning their composition [12] taking into account costs related to the qualitative level of shipping [13]. These costs depend on the type of freight  $r$ , type of rolling stock  $u$  that performs the shipment, type of packaging  $m$ , method of loading  $\pi$  and unloading  $p$ , and also distance of shipment from shipper  $e$  to receiver  $a$ .

The following expenditures were taken into account in modeling: (1)  $3_{ru}^m$  for packing the freight for shipment by rolling stock of type  $u$ ; (2)  $3_{re}^{pm}$  for loading-unloading (the costs indicated in the first two categories were taken in conformity with the rate schedules of [14]); (3)  $3_{re}^3$  for storage of freight and immobilization of capital in reserve at the supplier's place of business per unit of freight per day; (4)  $3_{re}^{tot}$  related to losses of quantity and quality of freight from waiting in the shipper's warehouse per unit of output per day (when calculating expenditures indicated in categories 3 and 4 consideration was given to variable expenditures of storing materials at a warehouse, which were taken as equal to 15 percent of the cost of the freight on an annual calculation, which corresponds to national economic losses if we are guided by the established norm of national economic efficiency); (5)  $3_{ruj}^{tp}$  per ton of freight resulting directly from its transportation from shipper  $e$  to consumer  $k$  by rolling stock of type  $u$  and make  $j$ ; (6) because of loss of quantity and quality ( $p_{k\&l}$  and  $p_{k\&u}$ ) of freight in the transportation process depending on the type of rolling stock which, for the price of standard ( $U_c$ ) and nonstandard ( $U_{uc}$ ) output, are:  $p_{k\&l}U_c + p_{k\&u}(U_c - U_{uc}) = 3_{ru}^{tot-tp}$  (norms of natural loss of freight were taken into account here [15]); (7) related to violation of timeliness (reliability) of freight delivery, defined as the cost of the consumer's maintaining an additional reserve supply equal to his requirement for this freight during the maximum time  $t_{rk}^{max}$  between the day of issuing the order for freight shipment and the time of freight delivery; if the cost of maintaining a unit of reserve supply for the consumer is  $3_{rk}^{ct}$  and his daily requirement is  $v_{rk}$ , expenditures are  $3_{rk}^{ct} v_{rk} t_{rk}^{max}$  (the cost of keeping a unit of reserve supply was taken as equal to 12 percent of the cost of the freight, and the daily requirement was assumed to be equal to the consumer's order); (8) caused by losses owing to refusal to ship freight during the entire period, that is, when this freight will not be used at all these costs can be taken conditionally as equal to the cost of the unshipped freight itself  $Q_{r\&k} U_{cr}$ ; (9) related to vehicle downtime with incomplete use of the carrying capacities of available rolling stock. If  $3_{uj}^{tp}$  is losses from downtime of a vehicle of make  $j$  for one day and  $a_{uj}^{tp}$  is the number of vehicles down, then these

losses will be  $3_{uj}^{np} A_{uj}^{np}$ .  $3_{uj}^{np}$  included 50 percent of the wages of drivers and overhead expenditures for one vehicle-day of work.

In calculating the costs of motor vehicle transportation both direct and supplementary expenditures to pay driver wages (rating, supplement to wages) were taken into account. All types of direct expenditures — for current repair and mechanical maintenance, depreciation of the vehicles, and fuel — were calculated for the total amount of driving, which was determined through the coefficient of use of driving distance with due regard for established shipping routes [16]. This coefficient varied from 0.5 to 0.75 depending on the distance, type of freight, and type of rolling stock.

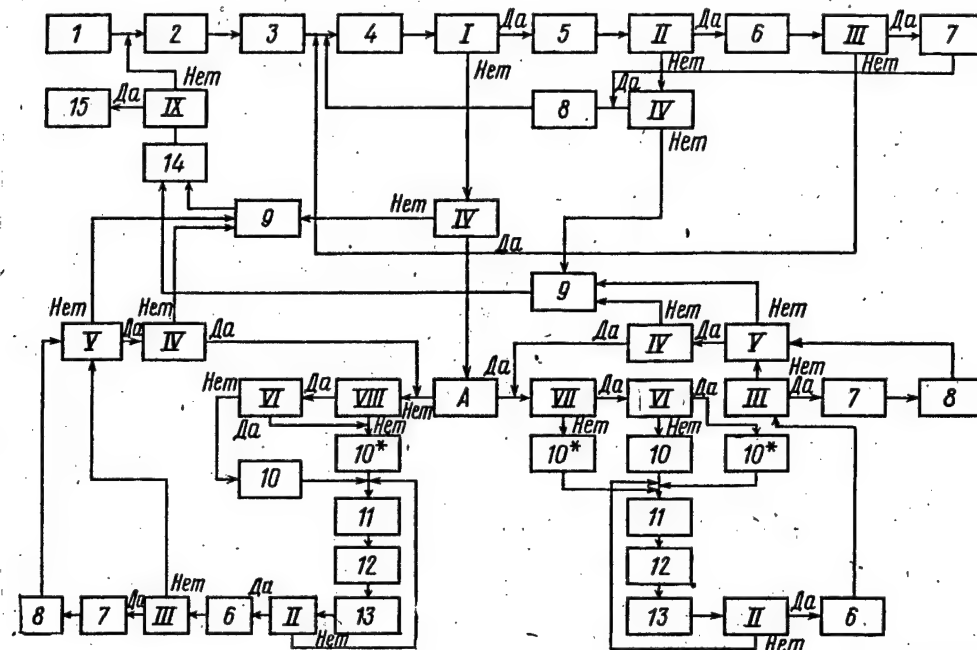
Therefore, the sum of national economic costs to move freight from the shipper to the consumer is

$$C = \sum_{ru,uj} (3_{ru}^m + 3_{ru}^{np,m} + 3_{ru,uj}^{tp} + 3_{ru}^{not,tp}) Q_{ru,uj} + \sum_{re} (3_{re}^s + 3_{re}^{not}) \times \\ \times Q_{re}^{OTH} T_{re}^{OTH} + \sum_{rh} 3_{rh}^{ct,s} v_{rh} t_{doc}^{max} + \sum_r Q_r^{OTH} \Pi_{cr} + \sum_{uj} 3_{uj}^{np} A_{uj}^{np}.$$

The first component in this expression is expenditures for packaging, loading-unloading, and transporting the freight; the second is costs related to the freight being held at the shipper's place of business; the third is losses because of failure to deliver the freight to the consumer at the right time; the fourth is losses because of refusal to ship the freight; and the fifth results from downtime of unused rolling stock.

During simulation of the functioning of GATP's under conditions of both the existing system of planning indicators and the proposed system it was assumed that the carrying capacities of motor vehicle transportation and shipping orders were equal. All technical-operating and economic characteristics of vehicle use and indicators of specific expenditures described above were taken as identical. Thus, simulation was done with due regard for identical conditions of work for the GATP, but with different systems of evaluating its activity and determining material stimulation of employees.

The figure below presents a flowchart of the simulation algorithms. It has 10 standard blocks that perform different operations (we give them numbers according to the chart). They are: (5) — RPSZD — distribution of rolling stock by contract orders and change in remaining number of vehicles; (6) — OPZ — processing orders received for performance; (7) — ONGZ — processing orders on which freight is not fully shipped; (8) O0Z — processing rejected orders; (9) O0Z VD — processing rejected orders for entire day; and (10) RZP — compiling ranking of orders by a characteristic (RZP DOKhub; RZP PRuB); (11) — VZP — selection of noncontract order by characteristics; (12) — RPSZND — distribution of rolling stock by noncontract orders and change in number of vehicles; (13) UZShP — removal of orders from order ranking; (14) — PNTV — calculation of unused carrying capacities.



Flowchart of Algorithms for Simulation of Operational Decision-Making To Ship Freight Using the Existing and Proposed Systems of Planning and Economic Stimulation (at the motor vehicle transportation enterprise level)

Key: Да — Yes;  
Нет — No.

- (A) Existing System;
- (I) Is it a contract order?
- (II) Are there means to transport it?
- (III) Is there untransported freight?
- (IV) Are there carrying capacities in general?
- (V) Are there other orders?
- (VI)  $\Pi P^I > \Pi P^{II}$ ;
- (VII)  $TKM^I > TKM^{II}$ ;
- (VIII)  $\Delta OX^I > \Delta OX^{II}$ ;
- (IX) Period of Modeling Completed.

- (1) Feeding of Raw Data;
- (2) Generation of Orders and Carrying Capacities;
- (3) Feeding of Previous Day's Orders; Formation of Order Queue;
- (4) Feeding Orders from Queue;
- (5) RPSZD;
- (6) OPZ;
- (7) ONGZ;
- (8) OOOZ;
- (9) OOOZ ZD;
- (10) RZP DOKhub; RZP PRub;
- (11) VZP;
- (12) RPSZND;
- (13) UZShP;
- (14) PNPV;
- (15) Data Processing for Period; Change of Input Data.



The algorithm to simulate the process of making decisions about freight shipping is constructed as follows.

1. A queue of orders for shipping and carrying capacities of the GATP is formed "each day" using pseudorandom number pick-ups.
2. The orders of contract clients which were not satisfied the previous day have priority in the queue. Noncontract orders are located after contract orders in the organized queue.
3. Contract orders under both the existing workscheme and the proposed one are processed in the same way.
4. Noncontract orders are processed by different algorithms, and the type of system (existing or proposed) is assigned by a "key" value. When simulating the existing system the priority of acceptance of noncontract orders for performance is determined from the standpoint of plan fulfillment primarily in ton-kilometers, then by profit with subsequent maximization of income. With respect to the proposed system the priority of acceptance of an order for performance is established on the basis of data on plan fulfillment primarily for income and profit with later maximization of income.
5. When selecting rolling stock to perform contract order  $i$  (block RPSZD) preference is given to make  $j$  of rolling stock which insures maximum output in tons ( $i \max w_{ij}$ ) for the given distance in comparison with other makes of vehicles which can be used for this shipment. The need for make  $j$  of rolling stock  $A_{ij}$  to perform order  $i$  is equal to  $A_{ij}^{notp} = Q_{ij}/w_{ij}Th_i$ , where  $Q_{ij}$  is the amount of freight envisioned in order  $i$  for shipping by rolling stock of make  $j$ , in tons;  $Th_i$  is the length of time in the schedule-order for a work shift for the rolling stock in hours;  $w_{ij}$  is the output of vehicles of make  $j$  which are used to perform order  $i$ , in tons.

The available amount of rolling stock  $A_j$  of make  $j$  is compared with  $A_{ij}^{notp}$ . If  $A_j \geq A_{ij}^{notp}$ , the amount of freight accepted for shipping will be  $Q_{ij}^{notp} = Q_{ij}$ , and the number of unused vehicles of make  $j$  will be  $A_j^{oct} = A_j - A_{ij}^{notp}$ .

If  $A_j < A_{ij}^{notp}$ , the amount of freight accepted for shipping on order  $i$  will be  $Q_{ij}^{notp} = A_j w_{ij} Th_i$ , and unshipped freight will be  $Q_i^{oct} = Q_{ij} - Q_{ij}^{notp}$ .

6. Unshipped freight (block ONGZ) is processed as follows. A predetermined amount of possible undershipment of freight  $HD_i$  is selected from the order. If  $Q_i^{oct} \geq HD_i$ , an index of additional freight work is established and the next most efficient make of vehicle for shipping goods freight is selected:  $j' = j+1$ .

If  $Q_i^{oct} < HD_i$ , the losses from undershipment of freight are determined  $\Pi H_i = Q_i^{oct} C_i$ , where  $C_i$  is the cost of one ton of freight.

7. Based on the order accepted for shipping (block OPZ) the following are determined; the number of tons of freight shipped  $T_i = \sum_j Q_{ij}^{notp}$ ; the number of

ton-kilometers performed  $TKM_i = \sum_j Q_{ij}^{\pi p} l_i$ , where  $l_i$  is the distance of freight shipment on order  $i$ ; income received  $DOX_i = \sum_j \frac{DOX_{ij}}{w} Q_{ij}^{\pi p}$  and profit  $\pi p_i = \sum_j \frac{\pi p_{ij}}{w_{ij}} Q_{ij}^{\pi p}$

where  $DOX_{ij}(\pi p_{ij})$  is income (profit) per hour of work during performance of shipping by rolling stock of make  $j$  on order  $i$ , in rubles; expenditures for shipping  $\pi B3_i = \sum_j \lambda_{ij} Q_{ij}^{\pi p}$ , where  $\lambda_{ij}$  is specific costs of shipping one ton of freight, including costs for packaging, loading-unloading, and transportation as well as freight losses during shipping.

8. Noncontract orders are processed as follows. The orders are ranked (block RZP). The following ranking characteristics were adopted for simulating the existing planning system:

$TKM^{\Sigma} < TKM^{\pi \Lambda}$ : noncontract orders are ranked by decrease in distance of freight shipping  $l_i$  with storage of affiliation with the order; the character " $\Sigma$ " designates the amount actually accumulated and " $\pi \Lambda$ " represents the planned amount from the beginning of the modeling period;

$TKM^{\Sigma} \geq TKM^{\pi \Lambda}$  and  $\pi p^{\Sigma} < \pi p^{\pi \Lambda}$ : noncontract orders are ranked by decrease in profit  $\pi p_{ij}$  which can be received from shipping on order  $i$  by rolling stock of make  $j$ , with storage of affiliation to the order;

$\pi p^{\Sigma} \geq \pi p^{\pi \Lambda}$ : orders are ranked by decrease in incomes  $DOX_{ij}$  which may be received from performance of shipping on order  $i$  in rolling stock of make  $j$ , with storage of affiliation to the order.

When simulating the proposed system of planning indicators noncontract orders are processed with ranking by these characteristics:

$DOX^{\Sigma} < DOX^{\pi \Lambda}$ : orders are ranked by decrease in  $DOX_{ij}$ ;

$DOX^{\Sigma} \geq DOX^{\pi \Lambda}$  and  $\pi p^{\Sigma} < \pi p^{\pi \Lambda}$ : orders are ranked by decrease in  $\pi p_{ij}$ ;

$\pi p^{\Sigma} \geq \pi p^{\pi \Lambda}$ : ranking is done by decrease in  $DOX_{ij}$ .

From the scale of orders ranked by a certain characteristic the maximum  $l_i$  (block VZP) or maximum  $\pi p_{ij}$  ( $DOX_{ij}$ ) is chosen and the rolling stock to perform order  $i$  is identified (RPSZND). If rolling stock of make  $j$  is available the following are removed from the scale during ranking: by shipping distance — the order with characteristic  $i$ ; by income or profit — all values of  $DOX_{ij}$  ( $\pi p_{ij}$ ) with the characteristic of order  $i$ .

When carrying capacities of make  $j$  of rolling stock are not available, the value of  $DOX_{ij}$  ( $\pi p_{ij}$ ) belonging to the particular make is removed from the scale (block UZShP).



9. If there is no rolling stock at all or no vehicles of make  $j$  the order is put in the queue for the next day and at the same time a record is made of days of refusal to ship (waiting count) for freight  $C\pi_{i\tau}$ , where  $\tau$  is the number of the first day of refusal to ship. Where  $C\pi_{i\tau} \leq D_i$ , when  $D_i$  is a given maximum possible number of days that freight can wait under order  $i$ , a determination is made of losses from freight waiting in the shipper's warehouse  $3\pi_{i\tau} = \sum_i M_i Q_i^{0.15}$ ,

where  $M_i$  is expenditures for one ton of freight to wait one day, in rubles.

If  $C\pi_{i\tau} > D_i$ , the order is eliminated from consideration and losses from failure to perform the shipment are calculated -  $\pi_{HD_i} = \sum_i Q_i^{0.15} C_i$  (block 002).

10. In the absence of freight that can be shipped in vehicles of make  $j$ , a calculation is made of loss from underuse of carrying capacities

$\pi_{A_{uj}} = \sum_j h_{uj} A_j^{0.15}$ , where  $h_{uj}$  is daily expenditures for downtime of a unit of rolling stock of make  $j$ .

11. At the end of the period of modeling two determinations are made:

- the amount of working capital in reserve stock OC

$$OC = \sum_i (\max_{\tau} C\pi_{i\tau}) Q_i C_i 0.15,$$

where  $Q_i$  is daily requirement for freight shipment on order  $i$ ;  $C_i$  is the cost of one ton of freight, in rubles;  $\max_{\tau} C\pi_{i\tau}$  is the maximum number of days from the arrival of order  $a$  until its fulfillment; 0.15 is the coefficient for calculating one-time expenditures to establish working capital relative to ongoing expenditures;

- total sum of national economic cost

$$HX3 = \sum_i \pi_{B3_i} + \sum_i \pi_{HD_i} + \sum_i 3\pi_{i\tau} + \sum_j \pi_{A_j} + OC.$$

A program for the YeS-1020 computer was written using this algorithm. This program enables us to model the process of order processing for any preassigned period.\*

A comparison of the results of using the existing planning system with the proposed one based on a simulation of the shipping activity of a GATP was done with

\* The computer program was developed and the calculations made by NIIAT associates Yu. S. Tovb and A. A. Glebova.

a numerical example. The following initial data were assumed: maximum number of available rolling stock of nine different makes and types (dump trucks, vans, and stake-bed truck) — 94 units; maximum number of orders for freight shipment per day — 30, with each order indicating whether it belongs to a contract or non-contract client, the type of freight being shipped and its cost, shipping distance, daily volume of shipping in tons, what rolling stock (by make) can perform the particular shipment, output in tons, income and profit per hour of vehicle work, specific expenditures for the shipment, packaging, and loading-unloading, and extent of possible undershipment of freight by each make of vehicle for the particular shipment; expenditures for one ton of the particular type of freight to lie waiting at the shipper's warehouse; maximum possible number of days that freight can wait at shipper's warehouse; cost of daily downtime of unit of rolling stock by make; planned daily assignments for freight turnover, income, and profit for the entire GATP.

Calculations were made for four months of work (120 days). The table below presents the results. According to analysis of the results of modeling we may

#### Simple Results of Modeling

Name of Indicator	Planning System		Proposed
	Existing	Proposed	Existing, %
Freight Shipped, tons	218,700	217,900	99.6
Freight Turnover, ton-kilometers	4,663,600	4,657,200	99.9
Income, rubles	278,500	278,500	100.0
Profit, rubles	43,600	43,700	100.3
Total National Economic Expenditures, rubles	914,500	873,900	95.5
Included in above:			
Transportation Expenditures	379,700	376,500	99.1
Expenditures from Freight Delay	4,400	4,400	100.0
Losses from Undershipment	71,100	40,700	57.3
Losses from Vehicle Downtime	14,200	14,800	104.2
Working Capital	445,500	437,500	98.2

expect that the proposed system of ratified plan indicators for GATP activity will reduce national economic costs, primarily by cutting losses from undershipment of freight. Because the motor vehicle transportation enterprises themselves will receive practically identical results, introduction of the proposed system of ratified planning indicators for GATP's is expedient only from the standpoint of the national economy as a whole.

To give these enterprises an interest in lowering national economic costs of freight transportation not only should the proposed system be instituted,

but also at the same time rate schedules for freight shipment by motor vehicle transportation should be improved. These rate schedules should provide that the GATP's receive large income and normative profit when national economic expenditures for moving freight are reduced. With this in mind NIIAT is now developing proposals to improve these rate schedules.

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## MOTOR VEHICLE

### NEW RULES FOR VEHICLE SALES DISCUSSED

Moscow TRUD in Russian 5 Sep 82 p 2

[Article by A. Kazakov and S. Snegirev: "Car For Sale"]

[Text] The new rules on commission sales of cars and motorcycles with side-cars have taken effect in our country.

This is a noisy spot in Moscow, a lively place. Just as you enter Yuzhnoportovaya Street the "Motor Vehicles" store appears in front of you and it is as though you have entered a maelstrom of cars.

Our idea was this: to understand the new rules on commission trade in practice and to use them in the "purchase-sale" of a car made available for this sole purpose ... the newspaper's Volga. We asked for help in this from A. Kochetkov, deputy chief of the Administration for the Organization of Trade of RSFSR Mintorg [Ministry of Trade], and V. Antipov, director of the "Motor Vehicles" store.

As our Volga described imaginative zigzags in moving through the labyrinth of machines, Anatoliy Mikhaylovich Kochetkov explained to us the basic provisions of the new rules. We learned, for example, that now stores are accepting on commission automobiles only within the autonomous republic, kray or oblast where they are registered with agencies of GAI [State Motor Vehicle Inspectorate]. If commission sales take place in Moscow or Leningrad, then the automobile must be registered solely with the GAI of those cities.

"This will make it possible to put order into the sale of automobiles, to strengthen state and public monitoring of the procedure for their sale," A. Kochetkov said. "After all, as it was before a car owner from the capital could drive his Zhiguli, say, to the south to sell it, automobiles from the Urals were sold in Moscow and so on. All one had to do was to remove the automobile from the records, and where you sold it was no one's business. In that situation it was extremely difficult to keep records on automobiles, and so various deals and machinations were not uncommon."

We were approached in the store's sales lot by the person authorized to accept cars. He examined the Volga in a businesslike way, without haste, copied down the manufacturer's numbers of the basic assemblies and parts. And his very first question took us aback:

"What price are you putting on it?"

The point is that under the previous rules cars to be sold on commission were appraised by the store itself. They took into account the degree of the car's wear, the year of its manufacture, a number of other factors, and as a rule the price was set considerably lower than that at which the owner had purchased the car. And now this question.... Again we had to seek help from A. Kochetkov.

"This is in fact one of the main things that distinguish the new rules from the previous ones," he said. "Just as before they provide two ways in which a vehicle can be sold: impersonally or to a particular purchaser. But in the first case the owner of the vehicle now sets the price himself, which is not to exceed the state retail price for the given make and model in effect at the moment when the automobile is submitted to the commission. Your Volga, for example, was manufactured in 1977. Its retail price at that time was lower than now. But if you submit it for sale on commission, you are now entitled to appraise it at its present value. And this applies to all makes of cars. Of course, an experienced person authorized to accept cars, taking into account the car's condition, can suggest to you a more optimum price for a sale, but in any case the owner of the car still has the last word."

... Seeing an old and wornout Moskvich hiding at the end of the lot aroused certain doubts in us.

"Yes, but aren't there cases now when almost completely unusable cars go on sale on commission, and the prices of their owners set high new prices on them?" we asked A. Kochetkov.

"The rules take into account that if a car is not sold in the first 15 calendar days, the store marks it down in agreement with the former owner of the car. At the end of a subsequent 15 days, the car is again marked down, again with the owner's consent. If the car is not sold even in that case, its price is set by the store itself according to the rules of commission trade in effect."

Alongside the store there is yet another area where those who want to sell a car seek a specific purchaser. And, it must be admitted, the prices asked here are often far from those of the store. The "market prices" are set by the car owners, and this place is nothing more or less than a market. For a time we walked about here at the end, eavesdropping on the conversations of the habitues. We learned that the "market" prices dropped noticeably from the first days the new rules took effect.

We went up to a yellow Zhiguli, the first model. The owner of the car was a likeable young man with bushy hair. But his face was tired and pinched. We talked....

"This is the third day I have come here, and all in vain," he said. "Then again I am asking my price."

It turned out that he still did not know about the new rules. We explained them to him. A few minutes later we noted from the other end of the market that the yellow Zhiguli was being taken straight toward the gate of the display lot for commission sale of automobiles.

"The new rules have now been posted in all motor vehicle stores where automobiles are sold on commission," A. Kochetkov said as we were saying good-bye. "In addition, owners of a Zhiguli can now sell it through special auto centers and service stations of the Volga Motor Vehicle Plant."

It seems as if people actually intended to buy our Volga: a dozen or so interested people were already circling around it. We had to apologize, to explain the situation. We were followed by painful looks as we left the lot; our car is like new, and we "set" its price just below the retail price.

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## MOTOR VEHICLE

### SOCIALIST OBLIGATIONS OF AUTOMOTIVE WORKERS FOR FOOD PROGRAM REVIEWED

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 9, Sep 82 pp 1-4

[Article: "The Socialist Obligations of Motor Vehicle Builders"]

[Text] The May 1982 Plenum of the CPSU Central Committee, which approved the USSR Food Program for the period until 1990, defined the means of realizing it, and outlined paths of dynamic, comprehensive development of the agroindustrial complex, was an event of enormous importance in the life of automotive industry workers, as it was for all Soviet people. The decisions of the Plenum did not leave a single automotive industry worker indifferent; they wholly and entirely support and approve the new steps adopted by the party for development of the country and raising the well-being of the people. The collectives of enterprises and organizations are thoroughly, carefully analyzing accumulated know-how and trying to identify all reserves and opportunities for improving the work, for fulfilling and overfulfilling the primary task given to the sector by the Plenum: the task of transportation support for the agroindustrial complex.

For this reason, as is common knowledge, during the decade the automotive industry must deliver to agriculture 3,000,000-3,060,000 trucks, 3.2 million-3.3 million tractor trailers, and 50,000-53,000 livestock semitrailers; increase the delivery of specialized vehicles to sectors of the food industry for hauling sugar, live fish, and other food products; and give the sectors of the agroindustrial complex 76,000-78,000 refrigerator trucks for general-use transportation. Already during the 11th Five-Year Plan we must incorporate series production of specialized transportation vehicles to haul bulk and liquid complex fertilizers, insure further refinement in the designs of agricultural motor vehicles, and develop and build replaceable specialized beds. A great deal also needs to be done to fully meet the agroindustrial complex's requirement for spare parts for motor vehicles. The contribution to increasing food resources by increasing the production of food products at subsidiary farms should also be significant.

Guided by the directions and conclusions presented in the report of General Secretary of the CPSU Central Committee, Chairman of the Presidium of the USSR Supreme Soviet, Comrade L. I. Brezhnev at the May 1982 Plenum of the CPSU Central Committee and aspiring to make a worthy contribution to carrying out the USSR Food Program, the labor collectives of the associations, enterprises, and organizations of the Ministry of Automotive Industry have adopted stepped-up socialist obligations for delivery of their output to agriculture and other



sectors of the agroindustrial complex in 1982, for fulfillment of the sectorial program for motor vehicle transportation support of these sectors in 1982-1985 and the sectorial program "System of Vehicles for Full Mechanization of Agricultural Production in 1981-1990," and for the quality of motor vehicle equipment.

Thus, the socialist obligations for 1982 envision that all the collectives of the sector will fulfill quarterly and annual plans for delivery of motor vehicles, trailers, engines, spare parts, electrical equipment for motor vehicles and tractors, and the full assortment of assembly components to agriculture and other sectors of the agroindustrial complex ahead of schedule. The work results for the months of 1982 already completed show that the obligations are being successfully met. For example, in the first six months the plan for production of motor vehicles for agriculture was fulfilled; 133,000 trucks and specialized vehicles were delivered.

Major obligations have been assumed with respect to development of new designs and modernization of agricultural motor vehicles for the purpose of improving their transportation and technological qualities, service life, economy, reliability, and durability. Practically all the associations and enterprises, scientific research and production design organizations of the sector, and scientists at many higher educational institutions in the country will participate directly in this work. Reconstruction of the Kutaisi Automotive Plant imeni G. K. Ordzhonikidze is an example of the results of this cooperation and creative collaboration. This project will make it possible to meet the challenge posed for the ministry by the Food Program of creating capacities "for the production of 20,000 agricultural truck trains a year at the Kutaisi Automotive Plant." Another result is development of the elements of the rig itself: the KAZ-4540 tractor (Central Scientific Research Institute of Motor Vehicles and Motor Vehicle Engines and the Kutaisi plant), the trailer and bed (chief design bureau on tractor and motor vehicle trailers in Balashov), the engine (the Avtodizel' Production Association), the hydraulic equipment (Mytishchi Machine Building Plant), and the like.

The KAZ-4540 tractor (flatbed and dump-truck variations) together with the GKB-8535 trailer (load capacity of 5.5 tons) forms a rig with a load capacity of 11 tons. This is actually the first domestic transportation-production agricultural truck train. Its minimum speed is 2-2.5 kilometers an hour, so it can work with any slow-moving agricultural machinery (combines and the like). Tire pressure is comparatively low, which avoids a harmful impact on the fertile layer of the soil. The load beds of the tractor and trailer are self-dumping, have strengthened joints, and have large capacity which can -- when necessary -- be doubled by adding sideboards. This makes it possible to haul practically all solid and loose agricultural loads and to mechanize loading-unloading work.

Production of KAZ truck trains will begin in 1984 (the first industrial batch) according to the socialist obligations that have been assumed.

The Ural'sk Automotive Plant was given the task of building capacities to produce 10,000 Ural-5557 diesel dump trucks with load capacities of seven tons for agricultural truck trains with load capacities of 12.5-14 tons, insuring production of the first industrial batch in 1984, and beginning series production of them in 1985. At the same time capacities will be built with preparation for

producing GKB-8551 trailers with load capacities of seven tons at the Krasnoyarsk Vehicle Trailer Plant for hitching to the 14-ton truck trains.

The collective of the Kama Truck Plant has taken on the obligation of organizing production of motor vehicles for agricultural dumptruck-trains with a load capacity of 14 tons. The rig will consist of the KamAZ-55102 dumptruck and the GKB-8527 dumptruck trailer (with load capacities of seven tons apiece). In addition they are preparing to produce and in 1984 will begin production of the KamAZ-5410 truck tractor with a hydraulic drive system mechanism to tip the load for dumptruck-trains. This unit is designed for hauling bulk mineral fertilizer and other loose loads. The collective of the Irbit Vehicle Trailer Plant has obligated itself to produce the first industrial batch of dumptruck semitrailers with load capacities of 14 tons for the KamAZ-5410 in the same year. Other plants are also cooperating with the Kama Truck Plant. For example, the Neftekamsk Motor Vehicle and Dumptruck Plant is organizing production of tanker semitrailers to haul complex liquid fertilizers. It is building capacities and in 1985 will begin production of tanker semitrailers to deliver water (to remote pastures) and petroleum products; in addition, it is incorporating production of KamAZ-55102 dumptrucks. The Krasnoyarsk Vehicle Trailer Plant is beginning to produce GKB-8527 dumptruck trailers for KamAZ agricultural truck trains with load capacities of 14 tons, and in 1985 will begin production of refrigerator trailers with load capacities of 11.5 tons. The collective of the Baku Specialized Motor Vehicle Plant has obligated itself to begin production of refrigerator semitrailers with load capacities of 11.5 tons in 1983.

As always, the collective of the Moscow Automotive Plant imeni I. A. Likhachev has taken on important obligations. In 1984 they will complete experimental design work and begin building a diesel truck tractor for an agricultural truck train with a load capacity of 12.5 tons. Work began in 1983 to build capacities for production of diesel truck tractors with load capacities of 5.5 tons for agricultural truck trains with load capacities of 12.5 tons. Further, they are organizing production of vehicles (chassis) for the modernized ZIL-MMZ-554M dumptruck with a load capacity of 5.5 tons for the agricultural dumptruck-train with a load capacity of 11 tons. In 1984 they will begin producing a modernized chassis for the ZIL-132 feed mixing and distributing truck. Naturally, these obligations also envision building the corresponding capacities for producing new and modernized vehicle equipment.

The Gorky Automotive Plant is, of course, the enterprise whose output almost completely replaced draft transport at the kolkhozes and sovkhoses in the postwar years. Their vehicles today constitute more than two-thirds of the fleet in our agriculture. It is understandable, therefore, that the workers of GAZ [Gorky Automotive Plant] could not help adopting stepped-up socialist obligations to promote successful fulfillment of the Food Program. They have adopted such obligations. The first one is to step up the rate of production of GAZ vehicles which have received universal recognition in the countryside for their reliability, durability, and steadiness in operation. And the GAZ collective is as good as its word. In the first six months in 1982 the plant not only fulfilled, but overfulfilled the assignment established by the plan.

The plant has adopted equally important obligations to develop new equipment for agricultural needs. For example, it is envisioned that the plant will complete

preparation for production and begin producing small series of diesel engines and GAZ-4301 diesel trucks with load capacities of 4.5 tons for dumptruck-trains with load capacities of nine tons in 1983. One truck will save the national economy about 20 tons of fuel a year, reduce the need for drivers at the kolkhozes and sovkhozes, and save a considerable amount of metal.

Also in 1983 GAZ will begin producing the modernized GAZ-53-12 truck for an agricultural dumptruck-train which has better load capacity and other use qualities than its predecessor.

The Food Program includes, of course, a broad program of capital work in the countryside and in all sectors of the agroindustrial complex. As L. I. Brezhnev noted in his report at the Plenum, these projects should be considered the country's priority (shock work) projects. Plans envision many facilities for initial processing of output, warehouses and storage centers, and animal husbandry complexes in the next Five-Year Plan. The area of irrigated land will increase to 23-25 million hectares during the decade, and land improvement work will expand. About 160 billion rubles is being directed to construction of housing, roads, schools, and other facilities. Needless to say, the program of capital work cannot go forward without high-powered motor vehicle equipment. And automotive industry workers have obligated themselves to produce it.

For example, the collective of the Kremenchug Automotive Plant imeni 50-Letiya Sovetskoy Ukrainy in its socialist obligations has envisioned an increase in production and improvement in the reliability and longevity of KrAZ vehicles with good off-road capabilities. These trucks have long been favorites among construction workers, and now there will also be new models. The Belorussian Heavy-Duty Truck Production Association imeni 60-Letiya Velikogo Oktyabrya (BelavtoMAZ) adopted a resolution to step up the modernization of MAZ-5551 and BelAZ-7540 dumptrucks which are already in production and raise their load capacity to 9 and 30 tons respectively.

By fulfilling and overfulfilling state plans the motor vehicle building plants also make it possible for the plants that produce trailers, tankers, vans, refrigerator semitrailers, and the like to adopt increased socialist obligations. It was precisely this kind of cooperation that made it possible, for example, for the collectives of the Odessa Vehicle Refueling Aggregate Plant and the Grabovskiy Specialized Vehicle Plant to adopt stepped-up obligations to increase the production of tank trucks and tanker trailers for hauling petroleum products at the sovkhozes and kolkhozes; for the collective of the Yerevan Motor Vehicle Association to increase production of isothermic vans and refrigerator trucks; for the Caspian Machine Building Plant to produce AVV-3.6 tankers for hauling water to pastures and vans with lift gates for hauling incubating eggs and live poultry; and for the Tiraspol Vehicle Trailer Plant to begin in 1983 producing refrigerator semitrailers with a load capacity of 11.5 tons and by the last year of the five-year plan produce refrigerator semitrailers with a load capacity of 20 tons for MAZ Tractors.

The socialist obligations of the plants engaged in producing tractor trailers are also directed to fulfilling assignments arising from the Food Program ahead of

schedule. Thus, the Orsk Tractor Trailer Plant, the Ishim Machine Building Plant, the Balashov Vehicle and Tractor Trailer Plant, and the Chelyabinsk Machine Building Vehicle and Tractor Trailer Plant have resolved to increase the production of 1TTS-9 and 3TTS-12 trailers with increased load capacities and to prepare for production of 3TTS-13 and 3TTS-14.5 trailers with load capacities of 13 and 14.5 tons respectively. The workers of the Dzhankey Machine Building Plant have obligated themselves to produce GKB-887AN trailers with replaceable beds designed for use together with tractor trains to work with silage gathering combines.

The socialist obligations adopted for the 11th Five-Year Plan have one extremely important characteristic : comprehensiveness. This means a thorough consideration and encompassing of practically all questions related to solving the problems of the Food Program. The obligations envision not only increasing the production of agricultural means of transportation and updating their composition (modernizing five types and completing experimental design work on 14 types and models), but also building assemblies, aggregates, parts, electrical equipment, and the like with increased service life, which reduces the specific labor-intensity of technical servicing, expenditure of spare parts, and technological support for production and use.

For example, a number of production associations such as AvtoVAZ, GAZ, and Moskvich, have obligated themselves to design, manufacture, and deliver ahead of schedule the special technological equipment necessary to create capacities for the production of new agricultural motor vehicle equipment and to bolster technical aid to the enterprises that produce this equipment in installation and adjustment of new equipment and new industrial processes. The collectives of the enterprises of Soyuzpodshipnik [possibly All-Union Association for Bearing Production] intend to increase the production of progressive designs of bearings for agricultural machinery. The Yarsolavl engine building workers, after analyzing their capabilities, have decided to increase the service life of engines and fuel equipment designed for the K-700 and K-701 tractors and sprinkling and watering devices and to organize and switch to factory repair of their diesel engines in 1983. All the enterprises of the production and industrial associations engaged in manufacturing assembly components and spare parts for the equipment of agriculture and other sectors of the agroindustrial complex have obligated themselves to sharply increase deliveries and raise them to the normative need levels. There will be further development of the factory servicing systems for vehicles from the Kama Truck Plant. The Belorussian and Minsk automotive plants will increase the number of spare parts supply depots and provide help in technical servicing of BelAZ and MAZ dumptrucks used by enterprises and organizations of the agroindustrial complex in construction, land improvement, and other work.

The socialist obligations of the labor collectives of the sector also reflect the task posed in the decisions of the Plenum of increasing food resources by establishing subsidiary farms and developing and improving the service sphere for the rural population. Specifically, the collectives of 90 enterprises of the sector have adopted resolutions to build or improve their subsidiary agricultural operations and raise annual production of meat to 4,000 tons, milk to 3,000 tons, potatoes to 5,000 tons, vegetables to 6,000 tons, fish to 600 tons, and eggs to 1.5-2 million. Many associations already have experience with this work. The

Avtodizel' Production Association, for example, has set up a strong subsidiary farming operation which already today can meet the needs of its workers for dairy products and significantly add to available resources of numerous food products. At the Yaroslavl Engine Plant, the Gorky Automotive Plant, and several other enterprises industrial hot water is increasingly used for fish culture. As for the quality of services, collectives of the enterprises that produce motor vehicle motorcycles, and bicycles for personal transportation have assumed the obligation of insuring timely, good-quality technical servicing and repair and insuring that technical servicing stations located in rural areas are fully supplied with spare parts. At least 10 mobile specialized brigades will be set up each year for technical servicing and repair of motor vehicles belonging to citizens who live in remote rural areas.

The socialist obligations also outline steps to increase help given to kolkhozes and sovkhozes: bolstering the material-technical base; building production, housing, and cultural-domestic facilities; mechanizing agricultural work, and so on.

Thus, the stepped-up socialist obligations of the collectives of motor vehicle building workers cover practically all the problems involved with the Food Program and take account of real possibilities and reserves for raising labor productivity. This is understandable. The working people of the sector have received and studied the program as their own personal affair and they consider socialist competition an important means of accomplishing this task.

Socialist obligations have been adopted in the collectives of the associations, enterprises, and organizations of the sector and also at an expanded meeting of the Collegium of the Ministry of Automotive Industry and the Presidium of the Central Committee of the trade union of workers of motor vehicle, tractor, and agricultural machine building. The Collegium, the Presidium of the Central Committee of the trade union, and all the participants at the meeting called on workers of the automotive industry to undertake socialist competition to fulfill and overfulfill the assignments of the USSR Food Program and assured the Central Committee and General Secretary of the CPSU Central Committee Comrade L. I. Brezhnev that automotive workers will make every effort by heroic labor and new achievements in labor to insure successful accomplishment of the tasks posed by the May 1982 Plenum of the CPSU Central Committee.

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## MOTOR VEHICLE

### SHORTAGE OF QUALIFIED MECHANICS DISCUSSED

Alma-Ata AVTOMOBIL'NYY TRANSPORT KAZAKHSTANA in Russian No 9, Sep 82 p 38

[Article by K. Olshauskas, graduate student at the Moscow Highway Institute:  
"Repair Workers: Problems and Ways to Solve Them"]

[Text] The article below is a continuation of our discussion of worker training for motor vehicle transportation (for earlier articles see Nos 4, 6, 7 and 8).

Motor vehicle transportation has had a problem of a shortage of repair workers for a long time. The number of specialists in this category available today is 85 percent of the requirement, and mobility is 30 percent, almost 1.5 times greater than the average indicator in the sector.

Considering that the need for repair workers is growing every year and will double by 1990 compared to 1980, the problem of availability will become still worse.

The growing complexity of the designs of vehicles and industrial equipment imposes higher demands for the qualifications of these workers. Their vocational level has a significant effect on the technical condition of motor vehicles.

Considering the importance of this issue, an appropriate methodology was developed and an experiment was conducted using it. The study covered workers in the principal specialization: motor vehicle mechanic. The methodology envisioned analysis of the specific features of labor activity and a determination of the effect of workers' qualifications on labor productivity. All jobs involved in technical servicing and current repair of motor vehicles were grouped depending on difficulty.

Analysis of the data showed that the qualifications of repair workers influence the time of performance of different jobs in different ways. Qualifications become most important in the performance of complex jobs (complexity levels III-V). For example, in jobs on complexity level III mechanics with V ratings spend 20 percent less time than workers with ratings of III and 70 percent less time than rating I workers. Workers with ratings of III-V perform less complex operations (level II) in the same time, and mechanics with ratings of I and II take only one-third more time.



But it should be observed that complex jobs (levels III-V) constitute the bulk of the work, about 60-70 percent.

Photographic analysis of the working day of repair workers showed that their operational labor time does not depend on qualifications and averages 32-37 percent of total available work time.

Replacing mechanics with ratings of I and II with rating III workers raises the average rating from 3.4 (normative level) to 3.7. This change makes it possible to release about five percent of the workers and even to decrease total wage expenditures by 2-3 percent. Raising the average rating to 4.2 (replacing mechanics in ratings I, II, and III with rating IV workers) makes it possible to reduce the need for repair workers by 9-12 percent, and in this case expenditures for their wages rise only 1-2 percent. A further increase in qualifications does not produce a significant decrease in the total number of mechanics while the increase in expenditures to pay them rises significantly.

Raising the qualifications of repair workers involves increasing expenditures for their training and wages. Training expenditures depend largely on the level of worker mobility and the number of workers coming to the enterprise who do not have the necessary qualifications. It must be noted here that repair workers with low qualifications change place of work more frequently.

Thus, the rational average rating of repair workers based on minimum wage expenditures ranges from 3.7 to 4.2. If we determine requirements based on the efficiency of the entire motor vehicle transportation system, the rational level will be higher.

Now let us consider another specific aspect of repair labor which has a negative effect on the level of their qualifications and on mobility. The labor of a repair worker in motor vehicle transportation has a high degree of complexity. The mechanic must know the design and technology of performance of technical maintenance and current repair for 3-7 makes of vehicles. Because the volume and nature of freight shipping do not always make it possible to set up large motor vehicle transportation enterprises, there are certain restrictions on the division of labor among repair workers. Often they have to be universalists, combining the specializations of mechanic, welder, and lathe operator. It is difficult to overestimate their role in the overall process of organizing the work of motor vehicle transportation. But their wages today do not correspond to the volume of work they perform. Their wages are about 60-70 percent of the wages of drivers.

There are other problems as well. The management at many motor vehicle transportation enterprises does not give adequate attention to improving the working conditions of repair workers. These factors taken together are the cause of the high level of mobility and the low prestige of this occupation. A questionnaire survey showed that more than half of the respondents intend to change their specialization; an absolute majority of the group want to work as drivers, while 42 percent are former drivers temporarily deprived of their rights.

The problem of training repair workers is a very broad one and demands special consideration. But we are only treating it briefly. In general-use transportation

workers in this personnel group are trained in three main systems: three percent at production-technical and technical schools; two percent at training combines; and, 95 percent at motor vehicle transportation enterprises. Students at production-technical schools study for three years and receive a worker rating of III, while students at the training combines (vehicle schools) receive a II rating after six months study, and at the motor vehicle transportation enterprise the first rating is given after six months of study without leaving the production job. Most repair workers are trained at enterprises, which increases workers in the low ratings by 1.5-2 times. This situation lowers the overall level of labor productivity among repair workers.

It follows from this that most repair and service personnel must be trained at professional-technical schools. But the motor vehicle transportation enterprises do have possibilities for improving the training system. Large-scale training to raise worker qualifications should be organized. This form of study is used extensively abroad.

Thus, the most rational and key way to solve the repair worker problem is to raise their qualifications. It will be necessary here to refine the qualifications requirement (taking into account the specific features of their labor) and to carry out a number of organizational measures.

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## MOTOR VEHICLE

### SOLAR-POWERED VEHICLE TESTED IN ASHKHABAD

Moscow GUDOK in Russian 8 Nov 82 p 4

[Article by L. Korzun, APN correspondent: "Solar-Powered Vehicle"]

[Text] An unusual minibus appeared recently on the streets of Ashkhabad, the capital of Turkmenia. A miniature solar power plant with output of 700 watts was installed on its roof. Solar energy is converted to electric energy, which charges the nickel-cadmium batteries of the electric minibus. It accelerates easily and smoothly, moves noiselessly, developing a speed up to 50 kilometers per hour, and does not pollute the air with exhaust gases. The capacity of the storage battery provides for 100 kilometers of mileage.

This is an experimental model and is the result of the scientific research of solar engineer scientists of Turkmenia and laboratory colleagues of the All-Union Scientific Research Institute of Sources of Current. The location for the experiment was not selected accidentally. Turkmenia is the republic with the highest number of solar days in our country: there are more than 240 clear days here annually.

"We took the minibus of the serially produced RAF-2910 Latvia for the experiment," relates the laboratory head, Candidate of Physicomathematical Sciences B. Bazarov. "The solar electric power plant installed on it is a preassembled metal design with hydrogen-filled cylindrical glass tubes, inside which silicon photocells are placed. The plant converts solar energy directly to electricity."

The storage batteries of the minibus are continuously charged during the day and there have been no problems in operating it. But what about nighttime and during overcast days? The storage batteries can then be charged at a special recharging station, which has already been constructed. Solar energy is converted to electricity by using photocells and is stored in large storage batteries. These plants can also be used in regions where there is not as much suitable sunlight as in Turkmenia.

"Our goal now," concludes Bazarov, "is to increase the efficiency of the electric vehicle by increasing the capacity of the photoelectric modules. This will in turn make it possible to increase the mileage of the vehicle to 250 kilometers and the speed to 70 kilometers per hour. A solar recharging column can also be used to recharge the storage batteries of an electric vehicle."

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## MOTOR VEHICLE

### NEW GENERATION OF ZILS

Moscow GUDOK in Russian 2 Nov 82 p 4

[Article by O. Kokoulin: "A New Generation of 'ZILs' From Our Transport Colleagues"]

[Text] Fedor Nikiforovich Ksenenkov walked the thoroughfare of the third Mossnabpromtrans Motor Vehicle Combine with his customary, unhurried steps and went out to the vast truck parking area. Here, covered with snow, his truck train had become frozen. While the engine warmed up, the white cover began to melt and began to run off the hood of the vehicle in thin streams of water. Its radiator grill was moved forward in a smooth semicircle and the traditional shape of a ZIL [Zavod imeni Likhachev] was made longer and more streamlined. It seemed that the engine was cramped in the previous position.

"And this is amazing because after all it has 210 horsepower," explains the driver. "This is a three-axle ZIL-133 GYa--one of the most powerful modifications delivered recently to the conveyor of the Moscow Motor Vehicle Plant. It has almost double the load capacity of an ordinary model 130. Everything is due to the fact that the new truck is equipped with a diesel engine."

Again walking around the truck and having inspected the coupling of the trailer, F. Ksenenkov mechanically kicked each pair of wheels and then climbed into the cab. His route was the Severnyy River Port. To the point where enormous cranes transload bundles of logs from barges onto the timber carriers.

Skillfully maneuvering among the crowd of trucks, Feodor Nikiforovich moved toward the gates of the enterprise, past the pedestal where the one millionth ZIL has been immortalized in a memorial to the labor achievement.

We talked at one time about the triumphs related to the birth of this memorial and to the output of the two-millionth model, which was also turned over to the third combine, by the truck plant workers. The jubilee ZILs were also new modifications among the honorary export that travelled the streets of the capital here. True, F. Ksenenkov's vehicle was not always a timber carrier.

When it and 10 other vehicles arrived at the point of its permanent registration, the operators already knew the characteristics of the innovations and sought a sphere of influence for them where their use would provide the

greatest saving. The characteristics of the ZIL-133 GYa include the fact that it was developed in cooperation with KamAZ [Kama Automotive Plant]. The engines, chassis and axles come from KamAZ.

Based on the capabilities of the design, specialists of the Mossnabpromtrans Association decided to intensify it with a trailer (also produced by KamAZ) and to form a truck train with capacity of 18 tons. This is double the weight which gasoline tractors and semitrailers are capable of hauling. But diesel vehicles consume half as much as fuel in this case.

The association is now operating 50 gasoline-powered timber carriers. But the opportunity to reduce rolling stock significantly in this type of transport has now appeared. This is especially important in winter when all motor vehicles are switched to the service of the Odintsovko Timber Complex (supplied by rail) and the burden of delivery and perhaps empty runs increase significantly with termination of the navigation season. The number of ZIL-133 GYa vehicles at the third motor vehicle combine will reach 30 by the end of the year. It is planned to create 11 truck trains on their basis which will be able to transport just as much timber as 30 gasoline-powered ZIL-130V.

F. Ksenenkov frequently meets another participant of the truck parade in honor of the two millionth ZIL on the city routes. This model--the ZIL-138A-- is distinguished from the jubilee model only by a rack of eight red tanks attached under the bed of the truck.

Feodor Nikiforovich knows this truck does not need a gasoline refuelling column. It is perhaps the most economical in the country at present. The fuel for the ZIL-138A is compressed natural gas. Unlike the previously vehicle operating on liquefied gas, this one does not require industrial refining and is much less expensive than gasoline.

However, one can convert to liquid fuel immediately if necessary. The instrument panel of the truck has a special toggle switch. A single movement of the hand and the gasoline tank is switched on. Several universal ZIL trucks are undergoing experimental operation at the 41st Mostorgtrans Truck Combine.

"They approach the specifics of our shipments in their freight capacity--more than 5 tons," says the chief engineer of the enterprise B. Apushkinskiy. "The heavy weight of the gas tanks (each "pulls" 80 kilograms each) has absolutely no effect on the traffic qualities of the vehicle or its maneuverability. Rolling stock operating on compressed gas has given an excellent account of itself in summer. The exam under winter conditions is ahead of it."

Preparations are now being made at the motor vehicle plant for serial manufacture of the ZIL-138A truck. The first 15,000 of these trucks will enter the national economy by the end of the five-year plan. And the future of the plant is still not tied to them. The designers are working on development of a completely new diesel truck model. The plant will manufacture everything for it itself. Construction of a special plant for manufacture of diesel engines is being planned at the enterprise. So perhaps the latest ZIL-169 will appear within several years on the parking area alongside F. Ksenenkov's truck.

## MOTOR VEHICLE

### BRIEFS

MOTOR VEHICLE PRODUCTION--It is planned by the Supply Program to guarantee development of capacities for production of all-terrain motor vehicles at the Ural Motor Vehicle Plant at Miassa for the countryside during the current five-year plan. Construction of shops is under way here, where new Ural models will be produced. The main building is being erected by advanced industrial methods. Builders of the Uralavtostroy Trust [not further identified] have assimilated flow conveyor assembly of precast roof blocks of the main building. These blocks, measuring 24 X 12 meters, are assembled on the ground with all communications lines and are then erected on the building. The use of tubular trusses made it possible to lighten the structure and to conserve metal. [Text] [Moscow STROITEL'NAYA GAZETA in Russian 25 Aug 82 p 2] 6521

HIGHWAY CONSTRUCTION--A design has been confirmed for laying a new highway in Kuybyshevskiy Rayon. The asphalt route will pass through Poteshnaya naberezhnaya and will connect two bridges--the Matrosskiy and the Glebovskiy. The traffic part more than 11 meters wide will be laid along this route and sidewalks and wide median strips will be constructed. The design for the new highway was developed at the Mosinzhproyekt Institute [Moscow Institute for the Planning of Engineering Installations]. [Text] [Moscow MOSKOVSKAYA PRAVDA in Russian 11 Aug 82 p 3] 6521

VAZ-2701 PRODUCTION--The VAZ-2107 motor vehicle with plant No. 7,000,000 has come off the conveyor of the Volga Motor Vehicle Plant. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 34, Aug 82 p 3] 6521

IZHMASH ASSOCIATION--The 100,000th compact automobile has been assembled on the main conveyor of the Izhmash Association since the beginning of the year. At the same time, the collective has completed the main item of socialist pledges in honor of the 60th anniversary of the USSR--to convert fully to mass production of modernized low-displacement models. The Moskvich automobiles are equipped with reliable disk brakes and engines with increased motor life. [Text] [Kishinev SOVETSKAYA MOLDAVIYA in Russian 5 Aug 82 p 1] 6521

ZHIGULI SERVICE CENTER--Chardzhou--Construction of a VAZ [Volga Motor Vehicle Plant] special automotive center to service Zhiguli automobiles has begun in the oblast city. The design was developed by Kirgiz specialists and builders of the Chardzhoustroy Trust [not further identified] are conducting the work. The latest equipment and automated lines will be installed here in time. This permit preventive maintenance and "treatment" of 4,000 automobiles annually.

The new shop will become operational during the current five-year plan.  
[Text] [Ashgabat TURKMENSKAYA ISKRA in Russian 27 Aug 82 p 4] 6521

DIESEL ENGINE PRODUCTION--The reliability of the supercharged 600-horsepower diesel engine has been confirmed by state trials, which were completed at the Khabarovsk Dal'dizel' Plant. The vehicle was developed by specialists of the enterprises jointly with Leningrad scientists. The progressive design solutions guarantee high economy and long life of the engine. Compared to the engines presently produced, the model consumes one-third less metal. And the service life prior to major overhaul has been increased to 45,000 hours. By creating this unit, which will become the baseline model for more powerful second-generation diesels, the collective has completed one of the main items of the socialist pledges in honor of the 60th Anniversary of the USSR. The annual saving from using the new product with the Dal'dizel' mark will comprise 11 million rubles. [Text] [Moscow PRAVDA in Russian 24 Sep 82 p 2] 6521

PISTON RING PRODUCTION--Oil consumption increases, exhaust gases take on a bluish color and oil begins to leak through the seals and gaskets of the crankcase in a motor vehicle that has travelled more than 100,000 km (and sometimes even less). All this indicates extreme wear of the piston rings, which are sometimes replaced by new ones. Quite frequently the pistons also have to be replaced. In general major overhaul of the engine is required. A new design of compression rings, on the cylindrical surface of which a wear-resistant cermet coating is applied, has been developed at the Central Scientific Research Automotive and Automotive Engine Institute (NAMI). These rings operate for a longer period. Moreover, because of the high porosity of the coating, they easily "absorb" the lubricating oil and can operate temporarily under conditions of insufficient lubrication. Combination sealing of the piston with cermet compression rings in combination with chrome-plated precast wiper rings guarantees increased wear resistance of the cylinder-piston group and increases the operating life of the engine 1.5-2-fold. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 15 Sep 82 p 4] 6521

OREKHOVO-BORISOVO HIGHWAY--28 September, Vtornik--The two-stage design for reconstruction of one of the highways leading to Orekhovo-Borisovo has been confirmed. This access route to the housing tract will be two kilometers long. A new asphalt-concrete bed approximately 15 meters wide will be laid on the traffic part. It is planned to develop and plant shrubbery in the strip along the road. [Text] [Moscow MOSKOVSKAYA PRAVDA in Russian 2 Oct 82 p 3] 6521

TIRE PRODUCTION--The State Standard has confirmed the program for complex standardization "Pneumatic tires for compact automobiles," developed by USSR Minneftekhimprom [Ministry of the Petroleum Refining and Petrochemical Industry]. The program provides for reduction of the mass of tires, increasing the requirements on the quality of raw materials, materials and equipment, refinement of the grades and making more rigid the standards of the operating conditions of tires and also the specifications on pneumatic radial and bias-ply tires for compact automobiles. At the same time, requirements have been formulated on the reliability and precision of the production equipment designed for tire manufacture. The program is aimed at further improvement of future radial tires and specifically at reduction of their mass from 7.5 to

7.9 kg for VAZ motor vehicles, and increasing the average mileage to 50,000-55,000 kilometers. The expected saving from implementation of the program due to increasing the tire mileage will comprise approximately 60 million rubles per year. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44, Oct 82 p 13] 6521

BELAZ TRUCK PRODUCTION--Zhodino--An ever larger flatcar is required to transport the motor vehicles of the local plant. It is no joke that the natural weight of the serially produced 75-ton dump truck is 60 tons! The body, wheels and engine must be removed so that the height of the "pygmy" is four meters to transport it by rail. Our country exports Zhodino dump trucks to 35 countries of the world. Now, besides the 75-ton model, production of a 110-ton model has begun. A 180-ton truck, whose design contains many innovations, is undergoing trials. It can literally turn in place due to the change of rotation of the electric traction motors installed on the wheels. And the designers have already become involved with development of a new motor vehicle--a 250-ton giant. [Text] [Moscow GUDOK in Russian 22 Sep 82 p 4] 6521

ALL-TERRAIN VEHICLES--The LuAZ-969 M all-terrain vehicle, developed several years ago at the Lutsk Motor Vehicle Plant in Volyna Oblast, has gained wide recognition. This recognition came to the all-terrain vehicle due to its excellent operating qualities. Ruts and ups and downs, washed out track, fords and sandy soil mean nothing to it. The all-terrain vehicle develops a speed up to 90 kilometers per hour. It is used in agriculture, in timbering, in geological parties and for tourism. Work is now under way at the Lutsk plant on further improvement of the design of the all-terrain vehicle to increase its mileage, to improve comfort and safety and to reduce toxicity. The designers planned to use the exhaust gas heat to heat the interior. The Lutsk motor vehicle builders plan to bring production of the all-terrain vehicles up to 50,000 per year during the next few years. [Text] [Riga SOVETSKAYA MOLODEZH' in Russian 4 Sep 82 p 4] 6521

QUIET ENGINES--Tallin--The collective of the Volta plant has assimilated production of a new model of electric motor. These vehicles are practically noiseless. Their output has increased significantly with reduced weight. Production at the enterprise will be increased by one-third during the five-year plant. [Text] [Moscow GUDOK in Russian 1 Oct 82 p 2] 6521

VAZ-2121 EXPORTS--A total of 2,500 Niva automobiles will be sent to France this year by a contract concluded between the All-Union foreign trade association Avtoexport and the French company J. Pok. Since 1978, when the VAZ-2121 model first appeared on French highways, it has consistently enjoyed high demand among buyers. The excellent qualities of the all-terrain vehicle were clearly manifested during the autorally in Africa, where the Niva considerably surpassed its competitors in many phases. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 38, Sep 82 p 21] 6521

ARCTIC TESTING OF VEHICLES--A center for testing motor vehicles manufactured in the arctic version has been developed in the village of Berely, Magadan Oblast. The shops and laboratories occupy an area of 4,000 square meters. The mechanical section of the center can guarantee normal operation of 30



vehicles. And the Kolyma route, its sections toward Ust -Nera, Oymyakon and Magadan and also winter inhabitants serve as the proving ground. "The tasks of our enterprise are diverse," relates the deputy chief of the station A. Maramashkin. "But first we conduct road trials of trucks and buses at -40 to -60 degrees. The reliable technical base permits all the motor transport coming to Magadan Oblast to be checked here. [Text] [Moscow SOVETSKAYA ROSSIYA in Russian 1 Sep 82 p 1] 6521

KUTAIISI MOTOR VEHICLE PLANT--The output of diesel engines has begun at the Kutaisi Motor Vehicle Plant imeni Ordzhonikidze. This completes the most important phase of preparation for conveyor production of new truck trains for agriculture. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 40, Oct 82 p 4] 6521

AUTOMATIC LINE PRODUCTION--Belorussian SSR--The Kama Plant and its allies--the Krasnoyarsk and Stavropol Truck Trailer Plants--are the main customers this year of the Minsk Association for Automatic Line Production. The Minsk workers take special responsibility in fulfilling their orders. Hundreds of workers have pledged to complete the annual task ahead of schedule in honor of the 60th anniversary of the USSR. Since the beginning of the year, the creators of the automatic lines have already produced supplementary products worth more than 250,000 rubles [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 40, Oct 82 p 2] 6521

DUSHANBE BUS SERVICE--A letter the newspaper has received from Rogun, which was published on 22 August, said that workers at the shock construction site have difficulty going home from the capital of the republic in the evening. Incidentally, it was also impossible to leave Obigarm in the morning, which is mainly where the workers building the Rogunskaya GES live. The Ministry of Motor Transport, which this criticism was sent to for consideration, has sent in this reply: "As of 1 October two additional daily trips have been introduced on Route 237 'Dushanbe--Obigarm.' The buses leave the capital at 1530 and 1700 hours, and the next day they set off on the return trip from Obigarm at 0700 and 0800 hours." [Text] [Dushanbe KOMMUNIST TADZHIKISTANA in Russian 13 Oct 82 p 2] 7045

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